(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 613 306 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **94301100.7**

(51) Int. Cl.[5] : **H04N 7/137**

(22) Date of filing : **16.02.94**

(30) Priority : **22.02.93 US 20920**

(43) Date of publication of application :
31.08.94 Bulletin 94/35

(84) Designated Contracting States :
DE ES FR GB IT

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(54) Apparatus for controlling quantizing in a video signal compressor.

(57) A rate controlled VBR quantizing system includes a quantizer (14) for quantizing partially compressed video data and further apparatus (28) for monitoring the amount of compressed output data. Dependent upon the amount of compressed output data being lesser or greater than a predetermined value, the quantizer is conditioned (27) to operate in a fixed quantization mode, or a mode wherein only selected blocks of data in respective frames are adaptively quantized, respectively.

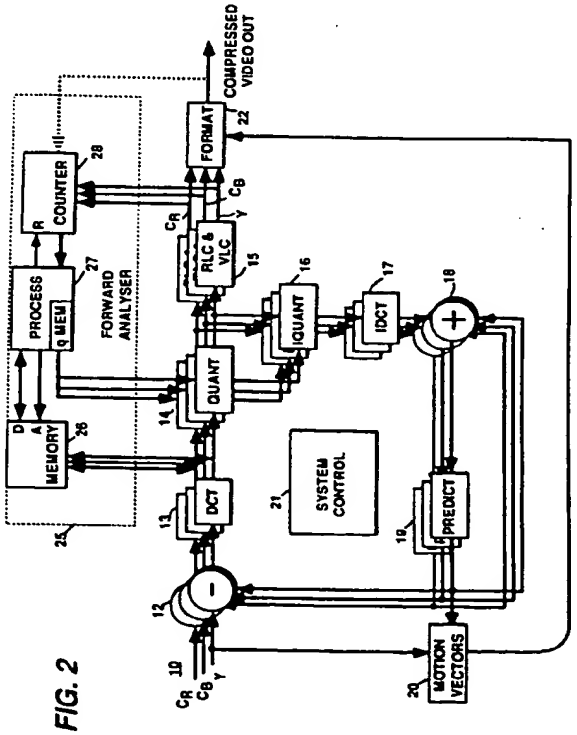

FIG. 2

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cludes;

means for statistically analyzing a predetermined plurality of said blocks of codewords; and means responsive to statistics of said predetermined plurality of blocks for generating said threshold value.

3. The apparatus set forth in claim 2 characterized in that said means for statistically analyzing provides a value representing the average volume of data per block, and the standard deviation of the volume of data from said average and said means responsive to statistics generates said threshold value as a function of said average and said standard deviation.

4. The apparatus set forth in claim 2 characterized in that said blocks of codewords are arranged in macroblocks and said apparatus further includes means for altering said threshold value on a macroblock by macroblock basis.

5. The apparatus set forth in claim 2 characterized in that said blocks of codewords are arranged in macroblocks and said apparatus further includes means for periodically altering said threshold value at predetermined numbers of macroblocks.

6. The apparatus set forth in claim 1 characterized in that said means for quantizing comprises:

a source of a matrix of quantizing values preselected for quantization of particular codewords in respective blocks;

means for weighting said matrix of quantizing values; and

means for applying a predetermined weighting factor to said means for weighting for respective blocks of codewords whose volume of data is less than said threshold value, and for applying adaptively generated weighting factors for respective blocks of codewords whose volume exceeds said threshold value.

7. The apparatus set forth in claim 6 characterized in that said means for quantizing further includes;

first memory means having preselected weighting factors stored at respective address locations;

second memory means having address locations corresponding to respective blocks of codewords, said address locations containing weighting factors previously applied for quantizing respective blocks; and

means for addressing said second memory responsive to weighting factors stored in said second memory means

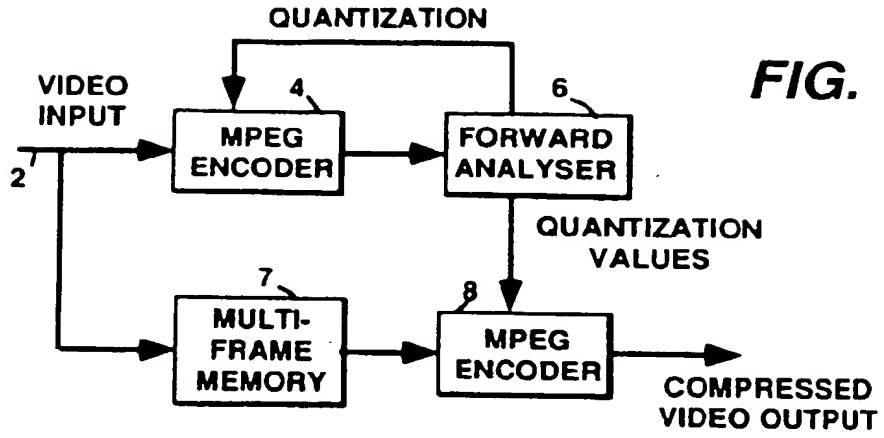

QUANTIZATION
VIDEO INPUT
2
4
MPEG ENCODER
6
FORWARD ANALYSER
QUANTIZATION VALUES
7
MULTI-FRAME MEMORY
8
MPEG ENCODER
COMPRESSED VIDEO OUTPUT

FIG. 1

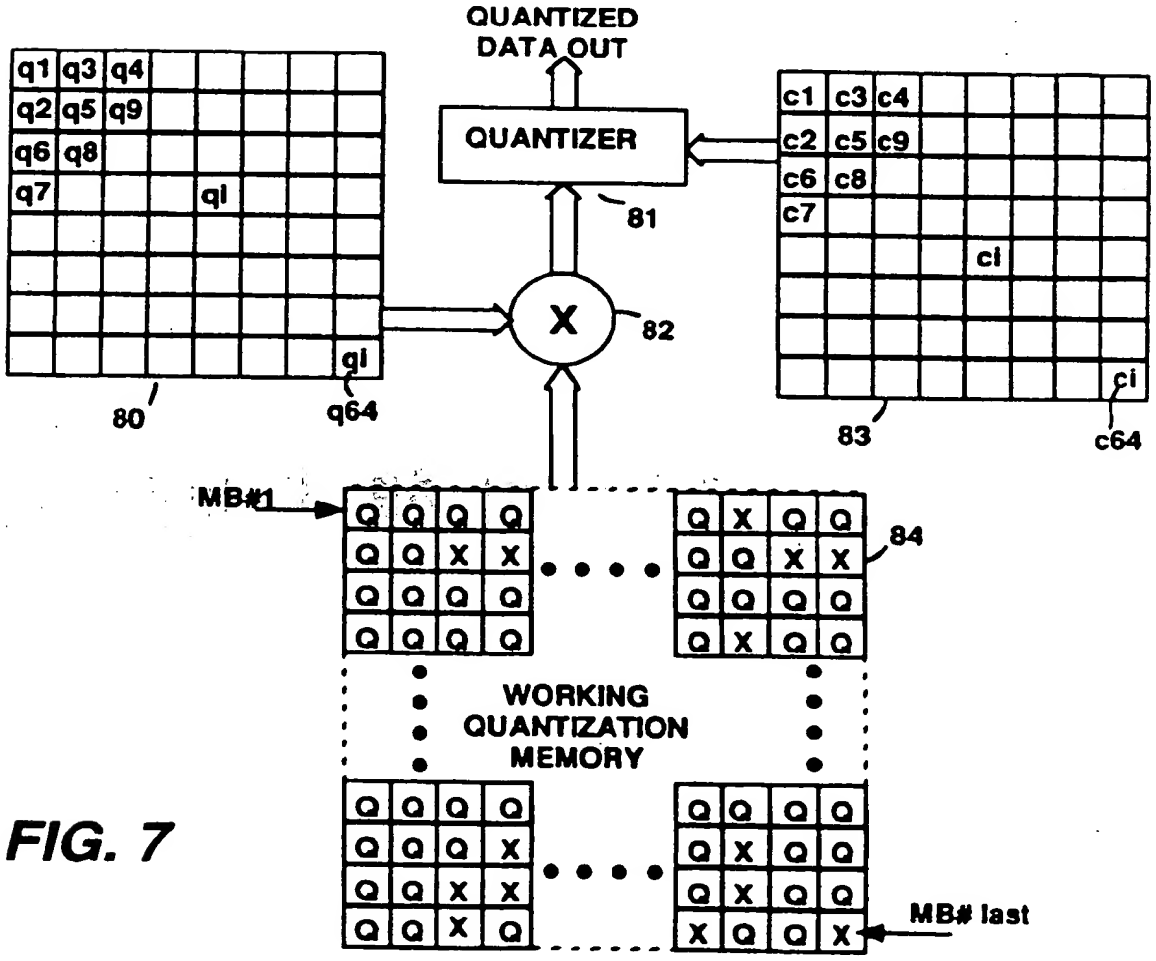

QUANTIZED DATA OUT
QUANTIZER
81
X
82
q1 q3 q4
q2 q5 q9
q6 q8
q7
ql
qi
q64
80
c1 c3 c4
c2 c5 c9
c6 c8
c7
ci
ci
83
c64
MB#1
84
WORKING QUANTIZATION MEMORY
MB# last

FIG. 7

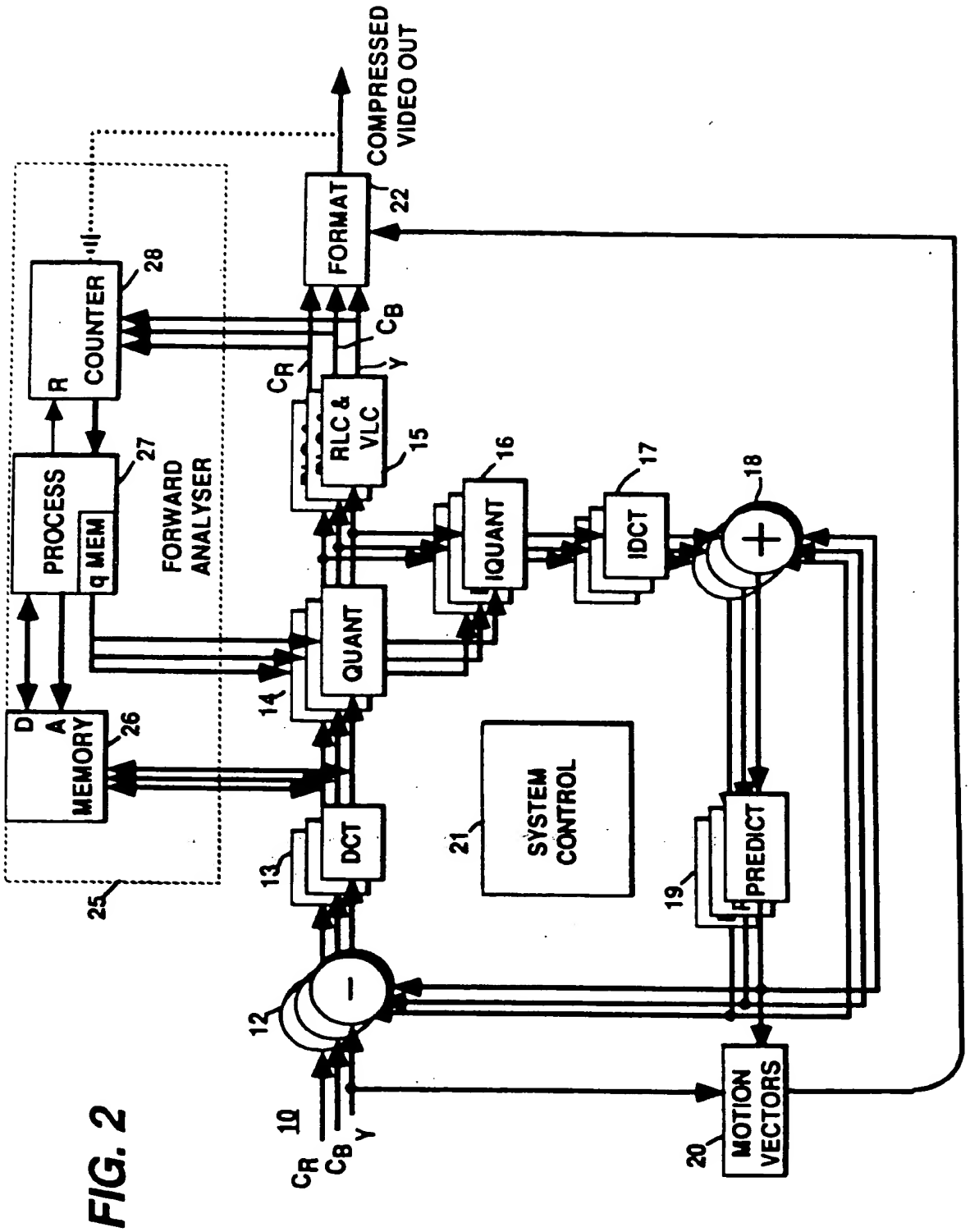

COMPRESSED VIDEO OUT
FORMAT
22
COUNTER
R
28
PROCESS
q MEM
27
FORWARD ANALYSER
D
A
MEMORY
26
25
RLC & VLC
15
QUANT
14
IQUANT
16
IDCT
17
18
DCT
13
SYSTEM CONTROL
21
PREDICT
19
MOTION VECTORS
20
12
10
C_R
C_B
Y

FIG. 2

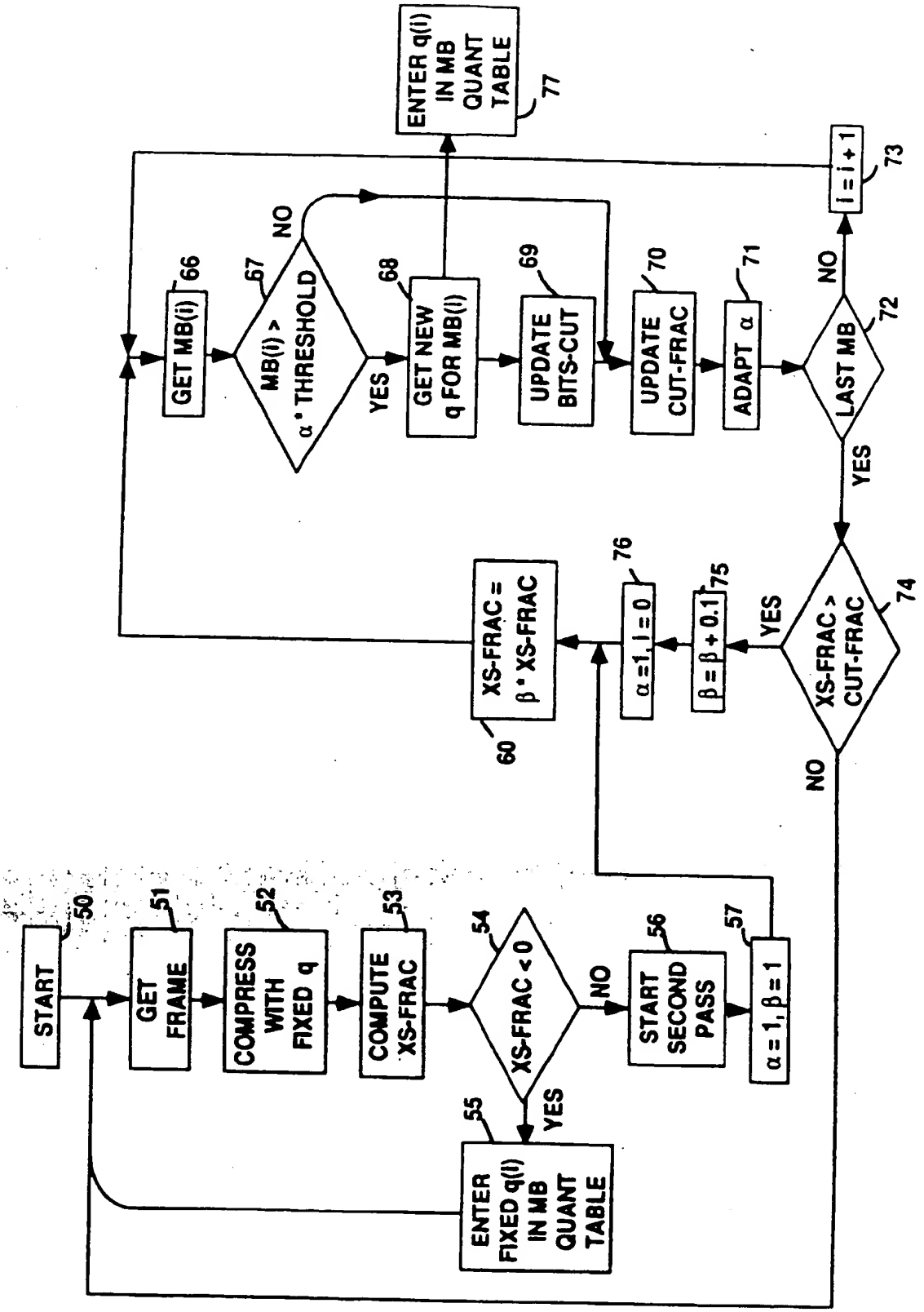

START
50
GET FRAME
51
COMPRESS WITH FIXED q
52
COMPUTE XS-FRAC
53
XS-FRAC < 0
54
YES
NO
ENTER FIXED q(I) IN MB QUANT TABLE
55
START SECOND PASS
56
α = 1, β = 1
57
XS-FRAC = β * XS-FRAC
60
α = 1, I = 0
76
β = β + 0.1
75
XS-FRAC > CUT-FRAC
74
YES
NO
LAST MB
72
YES
NO
ADAPT α
71
UPDATE CUT-FRAC
70
UPDATE BITS-CUT
69
GET NEW q FOR MB(I)
68
MB(I) > α * THRESHOLD
67
YES
NO
GET MB(I)
66
ENTER q(I) IN MB QUANT TABLE
77
I = I + 1
73

FIG. 3

I FRAME ADAPTIVE QUANTIZATION TABLE

New qI / Old qI	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	28	30	32
7	0	8	16	22	27	33	38	40	43	46	48	51	53	55	57	58	60	61	63	64	67	70	73
8		0	8	15	20	25	29	34	37	41	44	46	49	51	52	54	56	58	59	60	63	66	69
9			0	7	13	19	24	28	32	36	38	41	44	46	48	50	52	54	56	57	60	64	67
10				0	6	12	17	22	26	30	33	37	40	42	44	46	48	50	52	53	56	59	63
11					0	6	12	17	21	25	28	32	35	38	40	42	44	46	48	50	54	58	62
12						0	6	11	15	20	23	27	30	33	36	38	40	43	45	46	49	53	57
13							0	5	10	15	18	22	26	29	31	34	37	39	41	43	47	50	54
14								0	5	9	13	18	22	25	28	30	33	35	37	39	43	47	51
15									0	5	9	13	17	21	24	27	30	32	34	36	40	44	48
16										0	5	9	12	16	20	23	25	28	30	33	38	41	45
17											0	5	9	11	16	20	23	25	26	30	35	39	44
18												0	5	8	11	15	18	21	23	26	31	36	41
19													0	5	8	10	14	18	20	23	28	32	37
20														0	5	7	11	14	17	19	24	29	34
21															0	4	8	10	13	16	22	28	32
22																0	4	6	9	13	20	27	31
23																	0	4	6	9	14	19	24
24																		0	4	6	9	14	19
25																			0	4	6	9	14
26																				0	4	6	9
28																					0	4	6
30																						0	4
32																							0

xs-frac x 100 →

FIG. 4

B FRAME ADAPTIVE QUANTIZATION TABLE

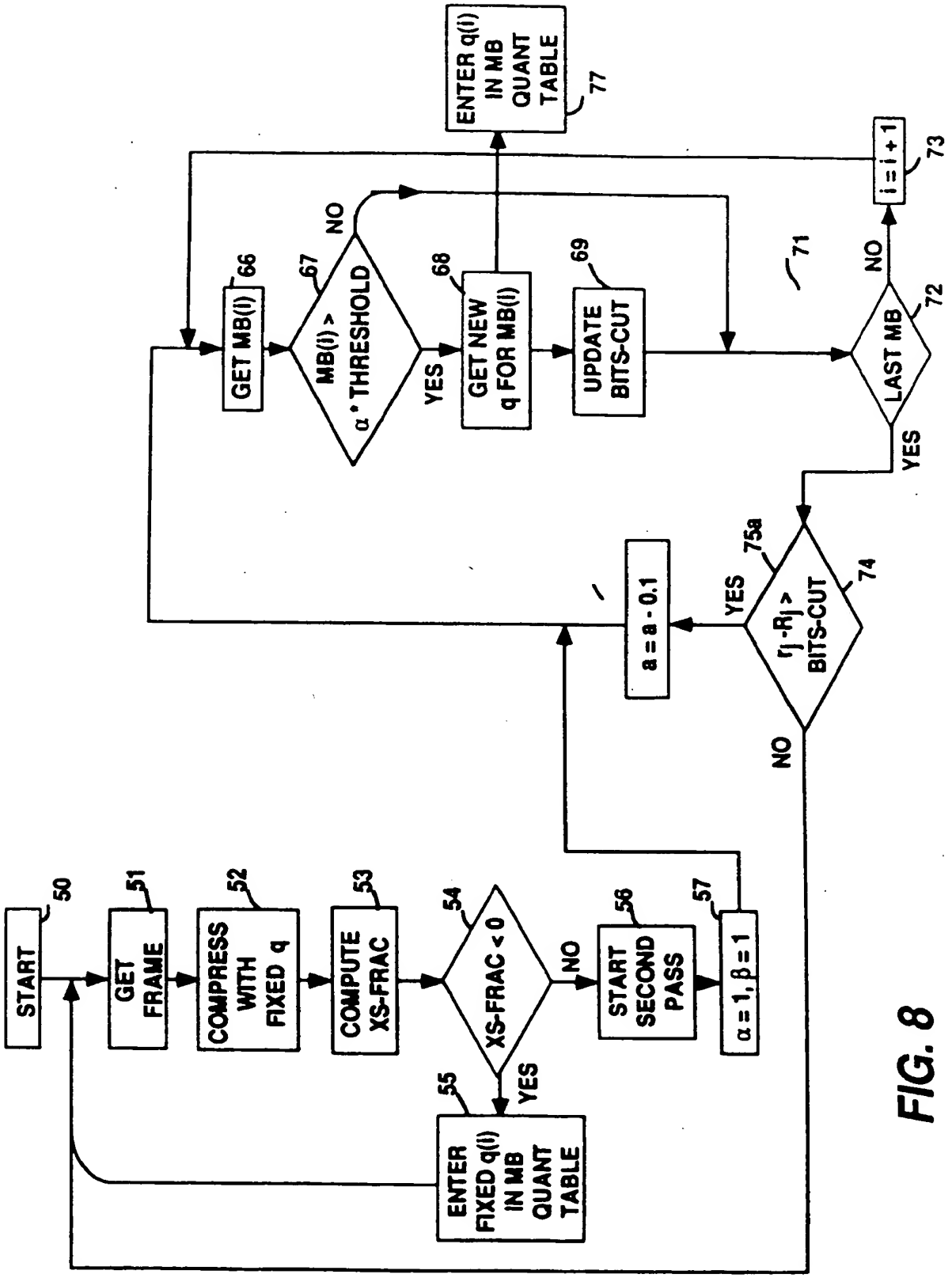
New qP / Old qP	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30	32
8	0	11	21	28	36	41	46	53	54	59	62	63	67	68	70	72	73	75	76	78	79	82	85
9		0	10	18	28	35	39	45	48	53	56	58	62	64	66	68	70	72	73	75	76	79	82
10			0	10	18	25	31	40	42	48	52	53	58	60	63	64	66	68	70	72	73	76	79
11				0	10	16	23	33	35	43	46	48	53	56	58	60	62	64	66	68	70	74	78
12					0	7	15	27	28	37	40	42	48	50	53	56	58	61	63	65	67	71	75
13						0	8	20	22	33	35	37	44	46	48	52	54	56	60	62	64	68	72
14							0	13	16	26	29	31	38	41	44	47	51	54	56	58	61	66	71
15								0	1	13	17	20	28	31	36	38	42	46	49	52	54	59	64
16									0	12	16	19	27	30	35	38	42	45	48	51	54	58	62
17										0	4	7	17	21	26	29	33	37	41	44	47	53	58
18											0	3	13	17	21	27	30	34	38	41	44	50	56
19												0	10	14	19	24	28	32	36	40	43	48	54
20													0	5	9	14	19	24	28	32	36	44	48
21														0	5	10	15	20	24	28	33	38	43
22															0	6	11	16	21	25	29	33	37
23																0	6	11	16	20	25	30	35
24																	0	6	11	15	20	28	33
25																		0	6	9	15	24	29
26																			0	5	10	23	28
27																				0	8	20	26
28																					0	6	20
30																						0	6
32																							0

FIG. 5

P FRAME ADAPTIVE QUANTIZATION TABLE

New qB / Old qB	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	32
10	0	15	20	30	40	50	52	55	58	60	64	65	66	71	76	77	78	80	81	83	84	86
11		0	5	17	29	41	44	47	50	54	57	59	60	66	71	72	74	76	78	80	81	84
12			0	10	25	37	40	43	47	50	55	57	58	64	70	72	73	75	77	78	80	83
13				0	16	30	34	38	41	45	49	51	53	60	66	67	68	71	74	73	78	81
14					0	15	20	24	29	34	39	42	44	51	59	62	64	67	69	72	74	79
15						0	5	10	15	21	27	30	33	42	51	54	57	60	63	66	68	72
16							0	5	11	15	20	25	29	39	49	52	55	58	61	64	67	71
17								0	6	11	17	21	24	35	44	49	52	55	58	62	65	70
18									0	6	14	17	20	31	42	45	49	53	56	59	63	69
19										0	6	11	14	25	37	41	45	49	52	56	60	68
20											0	4	7	20	33	37	41	44	48	52	56	64
21												0	6	15	30	35	39	42	46	51	55	63
22													0	10	28	32	36	40	44	49	53	62
23														0	8	18	24	29	35	39	45	55
24															0	6	11	17	23	29	35	48
25																0	6	12	20	26	29	37
26																	0	5	18	22	23	29
27																		0	6	15	19	28
28																			0	6	15	19
29																				0	6	15
30																					0	6
32																						0

FIG. 6


START
50
GET FRAME
51
COMPRESS WITH FIXED q
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55
START SECOND PASS
56
α = 1, β = 1
57
a = a - 0.1
rj - Rj > BITS-CUT
74
75a
YES
NO
LAST MB
72
NO
YES
71
i = i + 1
73
GET MB(I)
66
MB(I) > α * THRESHOLD
67
NO
YES
GET NEW q FOR MB(I)
68
UPDATE BITS-CUT
69
ENTER q(I) IN MB QUANT TABLE
77

FIG. 8

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 613 306 A3**

(12) EUROPEAN PATENT APPLICATION

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(22) Date of filing : **16.02.94**

(51) Int. Cl.[5] : **H04N 7/137**, H04N 7/30, H04N 7/50

(30) Priority : **22.02.93 US 20920**

(43) Date of publication of application : **31.08.94 Bulletin 94/35**

(84) Designated Contracting States : **DE ES FR GB IT**

(88) Date of deferred publication of search report : **20.09.95 Bulletin 95/38**

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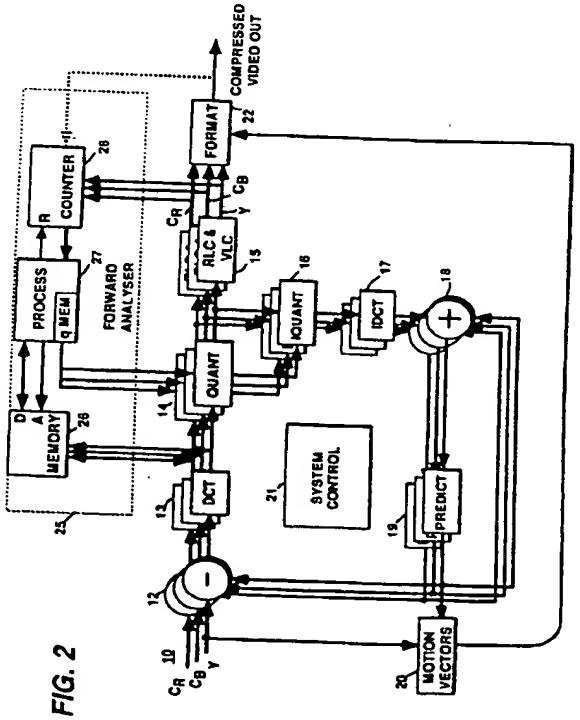

FIG. 2

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 1100

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	EP-A-0 380 081 (VICTOR COMPANY OF JAPAN) * column 6, line 44 - column 7, line 53 *	1,2	H04N7/137 H04N7/30 H04N7/50
X	PATENT ABSTRACTS OF JAPAN vol. 15 no. 343 (E-1106) ,30 August 1991 & JP-A-03 129983 (SONY CORP) 3 June 1991, * abstract *	1	
D,A	US-A-5 122 875 (RAYCHAUDHURI) * column 4, line 31 - column 7, line 51 *	1-7	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

H04N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	13 July 1995	Materne, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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